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ANKYLOSIS.*

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Ankylosis means "bent" or "crooked." I would define it as a morbid condition, the sequel of previous disease, involving a joint or structures connected with a joint in which the normal range of movement is reduced. Ankylosis never occurs as a primary lesion.

Any severe lesion of a joint or structures connected with it may terminate in ankylosis. Formerly (and even at this time in a few localities) it was considered an unavoidable consequence of fracture near by—or involving a joint. This condition has remained as a permanent affliction even from simple sprains.

Adhesion of tendons in the synovial canals or vaginæ is very apt to interfere with the movements of the wrist and fingers. This often follows infection of the hand. So will a contraction of the fascia due to irritation arrest movement, as evidenced in Dupuytren's contraction, similar contractions may occur elsewhere, and interfere with movements. Trauma to muscles moving any joint may produce more or less permanent restriction of movement. This is due to pain at first, and later to contraction of fascia caused by irritation, by continuity or by primary injury, or disturbance in the balance of tonus

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in the antagonistic muscles; for instance between flexors and extensors. Trauma to the joint itself or to any structure composing it means, of course, liability to ankylosis. In every purulent infection of a joint the danger of ankylosis is great. Of constitutional diseases, rheumatism, gout, arthritis deformans, tuberculosis and syphilis most commonly affect the joints with ankylosis as sequelæ, and lastly the ankylosis of old age, which grows upon us insidiously from childhood.

Functionally, we may classify ankylosis as—complete or incomplete. The incomplete may permit any degree of movement less than normal. The complete, of course, allows of no movement.

From a pathologic point of view, it is classified as true or false. In *true* ankylosis the bones composing the joint are grown together and connected either by actual bone or by fibrous tissue. The synovial membrane and even the articular cartilage may be destroyed, or the joint may be so surrounded by bony exostoses as to limit movement more or less completely. In *false* ankylosis the periarticular structures, the capsular ligaments, fascia or muscles may be involved. This may occur in the form of contractures, adhesions, more or less organized exudations and infiltrations. Ankylosis may be organic or functional. In the organic variety we find some or all of the before-mentioned conditions present, while in the functional, which may be due to reflex action or to hysteria, no lesion can be found in the joint. In including the hysteric joint in the ankyloses, I have been

accused of changing pre-existant nomenclature and thereby producing confusion. It is asserted that the hysteric joint is nothing but muscular contractures, one of the manifestations of hysteria and not an ankylosis at all, as there is no lesion present in the joint.

In this I cannot agree. Ankylosis—as before stated means "bent" or "crooked," and this word existed probably before organic and functional diseases were differentiated. Ankylosis is a condition, and to this condition the term was applied long before neurology or psychiatry was known or thought of. Hysteric ankylosis is a false ankylosis, it is functional, but it is an ankylosis, a condition just as real to the victim of hysteria as if it was a true organic ankylosis. As one cause of partial ankylosis I would cite: A joint with a capsule distended for a length of time with intracapsular effusion. When the intracapsular pressure finally terminates, due to reduction of the fluid by absorption or other means, the capsule fails to reduce, but forms pockets or become saccular. This joint is very irritable if movement is extended beyond a limited range. The patient takes great care not to attempt movement beyond this, therefore, the limitation of movement becomes fixed. I have called this a "saccular capsule." It is not an uncommon condition after sprains improperly treated.

As to hysteric ankylosis, there is no doubt about its existence. I attended a case of this kind for Dr. Van Hook. Miss E., aged 20, circulation and nutrition good; patient living in the country. The left elbow allowed of very

limited movement while patient was awake, and she would have a regular fit when the joint was flexed or extended beyond a small range. While under anesthesia the joint moved freely without any local reaction perceptible. The doctor told me, heretofore he had refused to believe in this type, but he was convinced that this was such a case. I gave her 14 sittings, the treatment consisting of suggestion, with carefully graduated passive and active movements, after which the function of the joint was perfectly normal.

I have seen a number of traumatic cases where no lesion could be found in the joint, and where the external structures were so slightly affected as to be insufficient reason for the restriction of movement which was due to pain. Also cases where the original injury of the joint had apparently been corrected, but still the patient complained of pain on moving the joint.

In some of these cases I have found the disability due to a traumatic bursitis—an inflammation of the serous lining of a bursa mucosa or bursa synovia. The joint I have had most trouble with in this direction is the shoulder. The subscapular bursa, situated below the subscapularis muscle, on the neck of the scapula, and connected with the synovial cavity by an orifice between the upper and middle glenohumeral ligaments is most often injured, in my experience. The bursa under the deltoid may also produce complications in a traumatic injury to the shoulder.

The pre- and subpatellar bursæ of the knee

are often involved in injuries of the knee, so are the malleolar bursæ in sprains of the ankle.

Respecting the purely senile ankylosis, I would advance this theory: As the inorganic salts are deposited in the osseous system, and in the other connective tissues, the radius of movements of the joints is reduced. After middle age, the bones are more saturated, the physical activity less, the glandular secretion and excretion are reduced. As much or more inorganic salts are introduced into the system by the nutrients, and less excreted. The surplus, after the bones are saturated, must find other parts for deposit.

Those tissues, where activity is reduced, fall a prey to such deposits, *i. e.,* fasciæ, tendons, synovial sheaths, producing reduction of function. (I can see no reason why the arterial walls and nerve sheaths should not as well be involved, producing arterio-sclerosis and perineuritis.) All these conditions occur mostly after middle age.

The diagnosis of ankylosis as a condition is simple enough. But as to prognosis and attempt to correction, it is in many cases a different proposition. It is often difficult, if not impossible, to decide between a false and a true ankylosis. If there is the least motion in the joint, it is worth the while to attempt correction without operative measures. Still, many cases I have seen where slight mobility was present have proved quite intractable to mechanical treatment. A correct and detailed history is important to help in making a decision. The deciding factor is palpatation and attempts

at passive movement. Where we can discern a perfectly solid joint, there is no hope for correction or improvement, except by producing an artificial articulation, nor where a joint is locked by periarticular bony exostoses. With a history of purulence invading the whole joint for a length of time, the chances are that the synovial membrane is destroyed and hope for reduction of the ankylosis is very faint, except by operation. Sometimes the infiltration, contractures and adhesions externally are so profuse that it is very hard to determine the condition inside the capsule. When it can be decided that the synovial membrane is mostly intact, a recovery of motion or at least improved motion can be assured. The history of the case will often settle this point.

The treatment of ankylosis should be *prophylactic*. Tine, expense and suffering would be reduced and often permanent invalidism prevented.

The conditions in which we have yet to learn to prevent ankylosis as a termination are arthritis deformans, destructive purulent infections involving the joints, certain non-purulent infections, as tuberculosis and syphilis, and even such cases as gout and chronic rheumatism may prove intractable if not attended to in the right manner in proper time. Vicious union of fractures in or near joints, if not corrected, may produce more or less complete ankylosis.

In arthritis deformans I have had some cases, and the best I was able to accomplish was an

arrest of the progress during treatment with massage. This condition comes on so insidiously that it is generally far advanced when treatment is called for. In its earlier stages it is confused with so-called "chronic rheumatism." I do not know of anything that will correct the subsequent ankylosis or arrest the progress of this disease permanently. I suspect it is a sequel of gonorrhea, if so, anti-gonococcus serum may be of advantage. I have no experience in this line.

In purulent affections of the joints it might lessen the probability of ankylosis to—in addition to routine treatment—have the joint surfaces separated by some kind of extension, and prevent any distension of the capsule by intracapsular pressure. As soon as the infection has terminated, and all danger of metastasis or recurrence has passed, the joint should be subjected to a treatment of massage and passive movements provided it is not so destroyed that all hope of movement is lost.

In tuberculous joints there is always danger of recurrence, even after all signs and symptoms have passed away. Facing this danger, the result of the labor expended to restore motion in a supposedly healed joint, by means of passive movements and massage, is so slight that it is not very encouraging.

The best result I have had in such a case was in a 5-year-old girl whom I attended for Dr. F. C. Eggert. This child had tuberculosis in both hip joints; a plaster cast had been on both hips alternately for about 3 years, and the process was considered terminated. When I first

saw her, June 25, 1906, her condition was as follows: Circulation, nutrition, general condition, fine; temper, bright and cheerful; body, plump and heavy for its size. It was difficult to discern any movement in either hip; the thighs were slightly flexed and well adducted. It was difficult to get a finger between the knees. She could not sit, but leaned like a stick, flexing her back, and could only walk by swinging her whole side forward; the heels were elevated and could not be separated much. I gave her passive movements and massage 3 times a week, with occasional short interruptions until January 20, 1908. At this time she could sit upright; could walk eight feet and 10 inches in 51½ steps without swinging her whole side. At this time, I had occasion to leave the city for a short time, and while I was away the original process seemed to recur, and she was put to bed for a short time, but the massage was kept up by a masseuse, and the last report I had she had improved again and was attending school, able to run and jump the rope. I never had so good a result in tuberculosis, and I do not think it is usual, and still it was not in proportion to the work applied to the case.

In syphilitic ankylosis I have had no result at all, and would not expect it. I attended to 1 case under the impression that it was gonorrheal. This involved the right knee, and was subsequently broken up with force under anesthesia, by another doctor, with disastrous results, requiring a splint for the leg for over 6 months thereafter, and without any improvement in the joint, which terminated in total immobility.

In the tabetic foot the weight of the body should be taken off at once. The lower tibial epiphysis softens, becomes plastic, and spreads out over the astragalus under the weight of the body forming an enlargement interfering with the ankle movement after the process is terminated. That is what happened in the only tabetic foot I ever attended. This occurred about 10 years ago. The patient had suffered from locomotor ataxia for 6 years previously, not diagnosed. On the advice of Dr. A. Loewy, gauze compresses saturated in 1 per cent bichlorid solution were applied to the foot and leg, besides massage (*effleurage,* or centripetal strokings exclusively), with passive movement of ankle were given. The synovial cavity was apparently not affected; the ankle movement was free and easy as far as the enlargement of the lower extremity of the tibia would permit. I attended the patient for 4 years after this. There was no recurrence of the articular trouble, and since massage was discontinued he had not suffered from any sensory or functional disturbance of the locomotor ataxia. He died suddenly from fatty degeneration of the heart, March 23, of this year.

The gouty joints are easier to prevent than to correct for the physician, provided the patient will comply with directions as to diet and exercise. When we have to deal with the local condition, I do not know of any better treatment than massage and movements between the attacks, constantly and daily, which will tend to prevent, delay or reduce the severity of the attacks. During the attacks a wet pack, cata-

plasma kaolini, or local application of hot air, will relieve or shorten the misery.

As to so-called "chronic articular rheumatism," I believe this synonym covers a multitude of sins. It is here impossible to use the same measure to fit all. Uric acid diathesis, infection and faulty metabolism producing autointoxication, with organic lesion in some internal organ, are all apt to be mixed up in this condition, and we may find any and all of them as etiologic factors in the general condition. Until the cause of the disorder is found, nothing but temporary relief can be assured and the local treatment recommended for gout will do as good here tentatively. After the cause in each individual case is determined, it may or may not be easy sailing. The cause must be removed or corrected. But by the time the seriousness of the condition is recognized, it is generally too late, if it ever was possible, and palliative measures must be resorted to.

Ankylosis due to simple synovitis should not present any great obstacles for correction, provided that intracapsular pressure has not been too intense or of too long duration. In cases of this kind, usually occurring due to trauma as sprains or contusions, local massage should be commenced at once, or as soon as possible after the injury. I prefer 2-3 times a day, the first few days, if possible, because thereby the effusion will be absorbed as soon as formed. If too much distension of the capsule be permitted, we will have a "saccular capsule," as described before, and a chronic condition.

With complications of bursitis, the bursæ should be either punctured and washed or com-

pressed, or both, but in case a constricting bandage is applied (preferably rubber) provision must be made to protect vessels and nerve trunks. This can be done by means of a padded and curved splint.

The ankylosis following a cast after simple fractures is not very formidable. A short course of massage and passive movements will correct it. But in cases of fractures in proximity to or involving joints, early precautions must be taken to insure good articular function. Gentle massage should be given as soon as 2 weeks after the cast is put on, the cast replaced, and the treatment repeated often enough to insure an accumulative effect. Passive motion is to be given to the joint affected as soon as the union is strong enough to stand a gentle and limited motion of the articulation in question.

The treatment of purely senile ankylosis is simple enough. As the normal physical activity is reduced during life, or the nutrients increased: Balance with medical gymnastics or systemic massage, which will maintain the glandular secretion and excretion in good condition, as well as the internal nutrition and respiration.

So much for the prophylactic part of the treatment. Now, a few words in regard to the corrective phase. I know of only 3 effective means of reducing an ankylosis in such cases, where ordinary exercise is not sufficient to restore normal function,—operative, the antitoxin treatment and mechanotherapy. The destroyed synovial membrane has been replaced by fascia, or other structures with success on

a number of occasions and wherever practicable. I expect this will be the routine treatment in all cases of total bony ankylosis.

The ankylosis due to infections of known origin I believe are very tractable with the various antitoxins now on the market. I had an experience in this a short time ago. Mr. B. called me for an ankylosis of left knee of 5 years' standing. Gonococcus infection about 8 years ago. I referred him to Dr. Dahlberg for injection of antigonococcic serum (P., D. & Co.). Temperature after first injection 103°; after second 99°; after third 98.4°. After this normal in function and free of pain. Considerable hyperplasia around joint existed which the patient was advised to have reduced by massage, but which he neglected.

In the false variety the best means to restore function is by manipulations and passive movements, to improve the circulation, and by forcible friction produce fatty degeneration of newly organized tissues. By centripetal strokings we promote the absorption of the débris so formed. In order to accomplish this in severe cases, active hyperemia has to be induced locally to promote the change of conditions.

Forcible breaking up under anesthesia should never be undertaken where the fasciæ are contracted. This would irritate the fascia and further reflex contractions would be the result. If forcible breaking up is undertaken, it should be done in installments, a little at a time, so as to reduce the reaction to a minimum and thus enable the patient by means of voluntary movement to maintain what is gained.

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